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Forthcoming Events.

JANUARY 26.

Institute of British Foundrymen:—Public meeting at Cardiff. "Shrinkage and Wrapping in Iron Castings," Paper by J. J. McClelland.

Swansea Technical College Metallurgical Society:—General meeting at Swansea. "The Fatigue of Metals," Paper by Prof. F. Bacon, M.A.

Institute of British Foundrymen (Newcastle and District Branch):—Ordinary meeting at Newcastle. Discussion on foundry problems, etc.

West Yorkshire Metallurgical Society:—Conjoint meeting with the West Riding of Yorkshire Branch, Institute of British Foundrymen, at Bradford. "Use of Scrap Metals," Paper by G. Lodgard.

JANUARY 29.

Institute of Marine Engineers:—Ordinary meeting in London. "The Gas Turbine," Paper by Hugh Campbell.

Sheffield Association of Metallurgists and Metallurgical Chemists:—Ordinary meeting at Sheffield. "Some Steel Works' Problems," Paper by W. H. Bailey.

JANUARY 30.

Royal Society of Arts:—Ordinary meeting in London. "The History, Developments and Commercial Uses of Fused Silica," Paper by Sir Herbert Jackson, K.B.E., F.R.S.

Institute of British Foundrymen (Coventry Branch):—Ordinary meeting at Coventry. "The Application of the Briquetting Process for Cupola Melting," Paper by T. Vickers, M.I.M.

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION.

Institute of British Foundrymen.

PRESIDENT, 1923-24, Oliver Stubbs, M.I.Mech.E., Openshaw, Manchester.

LIST OF SECRETARIES—

General Secretary: W. G. Hollinworth, 38, Victoria Street, London, S.W.1.
Lancashire: T. Makemson, 21, Beresford Road, Gorse Hill, Stretford, Manchester.
Birmingham: H. James Roe, 33, Herbert Road, Bearwood, Birmingham.
Sheffield and District: W. A. Macdonald, 62, Bannerdale Road, Sheffield.
Scottish: J. Bell, 60, St. Enoch Square, Glasgow.
London: H. G. Sommerfield, Woodhouse Road, N.12.
Newcastle-on-Tyne: H. A. J. Rang, 2, St. Nicholas Buildings, Newcastle-on-Tyne.
East Midlands: H. Bunting, 17, Marcus Street, Derby.
Coventry: J. M. Meston, 37, Melville Road.
West Riding of Yorkshire Branch: A. Love, 232, Gladstone Street, Bradford.

Welsh Engineers' and Founders' Association.

Secretary: E. J. Griffiths, 20, Fisher Street, Swansea.

Good and Bad Habits in the Foundry Trade.

Curiously enough, with one of the worst habits of the foundry trades in general is associated one of its best qualities. We refer to the custom of getting from other foundrymen metallurgical and other advice *gratis*. Possibly most problems are such that the anticipated profits are insufficiently large as to warrant the calling in of a consulting metallurgist or foundry expert. However, as a fair number arise in the course of a year, foundrymen should consider whether or not it is worth while employing such a person for an annual fee. Whilst the exchange of information is extremely commendable, it should be borne in mind that a foundry consultant, if he is worth his salt, would advise on the general conditions as distinct from the casting which is giving trouble, for no foundry has a monopoly of all that is best in foundry practice.

Another bad habit is the retention of plant which is either obsolete or inefficient. Whilst formulæ, based on "time in operation," "labour absorption," "efficiency," and other factors, are in existence, we believe that the average foundry manager is capable of evolving one personally and applying it to each item of plant in his charge. A carefully-prepared list would show which was the most urgent, and representation should be made to the general management or directorate for replacements in an order indicated.

Lack of system both in experimenting and the recording of results is another fault—unfortunately it seldom attains sufficient regularity to be called a habit. The average foundryman has usually only his skill and experience on which to base his expressed conclusions. He should cultivate the habit of recording all differences from what he considers to be normal for every job. The actual moulder has wonderful opportunities for this, even when engaged on repetition work. He may imagine that the cores were not so well baked as usual, that the sand was a little coarser or finer, that the metal was duller, that the mould was a little harder rammed than usual. These thoughts should be recorded under as many headings as possible, blanks being left for normal and only variations noted. If a moulder conscientiously filled in such a book daily, and he had the misfortune to be associated with a batch of wasters, he would be in a position to give his foreman an opinion, which at least emanated from an observant individual. With normal luck such a moulder would not remain long at his tools.

Whilst one could enumerate many other habits, both good and bad, we will leave the subject by suggesting that a good habit to cultivate is one which has in view the improvement of every-day tools, such as moulding box pins and lugs, barrows, sieves, ladles, rammers, etc.

The basic difference between the tradesman and the professional man is that the latter has a personal record of what he has accomplished, and if the moulder will do likewise, he will find the gulf between the two materially narrowed.

XUM

Institute of British Foundrymen.

SCOTTISH BRANCH.

Annual Dinner.

The annual dinner was held on January 11, at the Prince of Wales Restaurant, Glasgow, under the chairmanship of Mr. A. Laurie, the Branch-President.

The toast of the Institute of British Foundrymen was given by Mr. E. H. Lewis, the President of the West of Scotland Iron and Steel Institute, who dealt in an interesting manner with the early history of the foundry industry. Amongst other statements he mentioned that the oldest firm in Great Britain was the foundry concern of Mott, who started business on the other side of the street to their present premises in the East End of London in the sixteenth century. He considered that the prices of castings should be still further reduced, by means of better methods of production.

MR. OLIVER STUBBS, the President of the Institute of British Foundrymen, in reply, said that they as an Institute, always regarded the Scottish Branch as a very important section, and one which had in the past very largely influenced their progress. It had produced two presidents—the late Mr. William Mayer, of Dumbarton, who was the donor of the chain of office which it was his privilege to wear for the second term of office. The second president was his old friend Mr. Matt Riddell, who was one of the founders of the Scottish Branch, and who, he was glad to see, was in much better health. If Mr. Lewis, who, he understood, was connected with the blast furnace industry, desired cheaper castings, the obvious remedy was to lower the price of pig-iron. The Institute continued to make progress, and the latest development was the proposal to form a Branch in South Wales, providing adequate support could be obtained from the local foundries. That afternoon they had elected Mr. Bell as secretary, and he felt sure that under his and Mr. Laurie's influence the Scottish Branch would continue to make progress.

MR. J. AFFLECK, the Vice-President of the Branch, proposed the toast of the guests, mentioning that for the first time the Scottish Branch had invited the presidents of local kindred Societies. This was an innovation which he hoped would lead to the co-operation of the various societies in technical matters. The parent body was particularly well represented, for in addition to Mr. Stubbs, there were also present the President-elect, Mr. R. O. Patterson, of Newcastle, and Mr. W. G. Hollinworth, the General Secretary. He was also pleased to welcome two Branch-Presidents, Mr. V. C. Faulkner, of London, and Mr. J. Shaw, of Sheffield. Mr. Faulkner was editor of THE FOUNDRY TRADE JOURNAL, and had done much to advance the technique of foundry work. Mr. Shaw's work on test bars was universally appreciated.

MR. R. O. PATTERSON, who responded, said he was quite sure the guests were delighted with the reception accorded them. He agreed with Mr. Stubbs that wherever possible machinery should be introduced to lighten the work of the moulder, but its introduction should not be considered as a means for lowering wages, but rather should the workman share in any of the economies shown. There was still a very considerable amount of work to be done in educating the foremen and chargehands. However, their interest was now awakened.

PROF. A. L. MELLANBY, who proposed the Scottish Branch, referred to the innovation of having guests from kindred societies at their social functions, and suggested that they might go even further and have joint technical sessions. He suggested that a meeting between the local section of the Institute of Mechanical Engineers and the Scottish Branch to discuss the subject of Diesel engine liners would be of inestimable value. At the present time ships were not only carrying spare castings but also patterns in order to be prepared for breakdowns in foreign ports.

MR. MATT RIDDELL, who replied, said he regretted that his health had in recent times prevented his regular attendance. It was pleasing to note the interest which Scotch foundrymen were taking in the technical side of their work, and he was particularly gratified to see that so many of them had taken part in the International Foundry Congress in Paris. The preparation of sand was still but imperfectly understood by the average foundryman.

An excellent musical programme was provided by two members of the Branch, Messrs. A. Laurie and J. C. Dorsie, supplemented by professional artistes, Messrs. Watson, Kemp and Small.

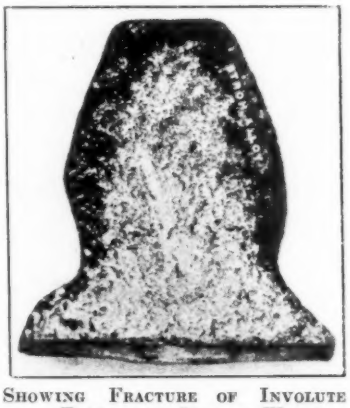
New Secretary Appointed.

Mr. W. H. Bound has resigned from the position of honorary secretary of the Scottish Branch of the Institute of British Foundrymen on joining the staff of Messrs. Cochrane & Company, Limited, of Middlesbrough. Mr. John Bell, of 60, St. Enoch Square, Glasgow, has been elected to the position.

The Stroh Process.

The Stroh process is a method of casting two steels in one operation—the highest-grade alloy steel with ordinary soft steel. The resultant casting combines the great advantage of alloy steel; viz., resistance to wear and abrasion, together with those of soft steel—strength, toughness, ease of machining, low cost, resilience, and resistance to fracture under shock.

The actual percentage of the weight of a steel casting which is worn away in practice is generally very small. The teeth of the average gear



SHOWING FRACTURE OF INVOLUTE TOOTH, THE OUTSIDE WEARING SURFACE BEING OF STROH ALLOY STEEL.

constitute less than 10 per cent. of the total weight. A worn tooth weighs one-half as much as a new. The remainder, or 95 per cent., has been used merely for supporting weight or stress and is never worn out. It is quite obvious that a hard material is of no benefit in this greater portion and is nearly always detrimental, both on account of the expense of machining and the nature of high-carbon or high-alloy steel. While the Stroh alloy is claimed to be the greatest wear-resisting steel known, it is rather costly; but, to get such an alloy in and on the parts subject to actual abrasion, and still to keep the easily-machined and cheaper material in the other 95 per cent., means to combine the advantage of both at a nominal increase in cost over the usual material employed.

A MEETING of the representatives of the whole of the Birmingham area of the Workers' Union has been held to consider the application recently put forward by the District Committee of the union to the Engineering and National Employers' Federation for an advance in wages on behalf of 18,000 workers in the engineering and allied trades in the Midland area. The increases asked for are as follows:—6s. per week to adult males, 4s. to youths of 18 and over, 2s. to youth under 18, 4s. to women of 18 and over, and 2s. to girls under 18; 15 per cent. increase on piece-work prices in the case of men, and an equivalent advance for women workers have also been applied for. It was resolved that the officers be instructed to press forward with the claim, which will be referred to a central conference at York.

Pulverised Coal in Open-Hearth Furnaces.

MR. R. H. LOWNDES (Chief Engineer Atlantic Steel Company, Atlanta), in a Paper presented at a meeting of the American Society of Mechanical Engineers, dealt with the subject of burning coal in the pulverised state in the open-hearth furnace.

In considering first the cost, he said it is necessary to take into account the cost of coal and the cost of crushing, drying and pulverising the coal and its delivery to the burners along with the necessary air. As regards cost of milling, there is first the cost of installation of a coal mill. If the coal mill cost, say, $25,000 (£5,000), a return of 6 per cent. would mean $1,500 (£300) per year. This, divided by the tons of coal milled, should be added to the cost of fuel per ton. Also a reasonable sinking fund, reckoned as a percentage of the investment, should be set aside for depreciation and obsolescence. Insurance should likewise be reckoned as an annual expense and charged to the cost of the fuel. Next is the cost of power to drive the mill, with its crushers, driers, pulverisers, elevators and conveyors, air compressors and fans; the labour cost, and cost of repairs and upkeep, oil, waste, etc.

Possible losses in fuel value in milling are more difficult to reckon. They are due principally to coal burned to dry the fuel; loss in volatile combustible driven off in the process of drying; loss in leakage of coal dust; loss in occasional emptying of bins to prevent packing or spontaneous combustion; loss in fires, which occasionally take place. The losses enumerated are all small. The coal burned to dry the fuel may be neglected. The loss in volatile is also apparently quite small. The best available data show an average loss of something less than 1 per cent. Mr. H. R. Collins, in 1918, stated that driers were manufactured which were able to eliminate moisture without distilling any of the volatile matter in the coal. He then described the modern drier, employing temperatures not greater than 300 deg. Fah., and stated that the volatile combustible matter was not likely to be driven off until the temperature rose above 400 deg. Fah.

Loss in coal-dust leakage is purely mechanical, and the latest mills have almost entirely stopped this. The loss in having to empty bins is also minimised by increased knowledge of the quantities of fuel necessary in any specific operation, and the consequent prevention of large accumulations in the bins. This same control also minimises the loss due to fires, and in the modern mill they are almost unknown.

Assuming, then, that coal can be pulverised at a cost of something like 65c. (say 2s. 9d.) per ton, with coal costing, say, $6.50 (27s.) per ton, the milling adds about 10 per cent. to the cost of the fuel. We have a right to expect this to be returned by virtue of the much-improved burning; and indeed, so far as the heat obtained is concerned, this additional expense is more than justified. This loss is less expensive than the B.T.U. loss in the gas producer. With good burners and proper air adjustment, what may be termed the carburation of the coal dust is so good that combustion is excellent.

Analyses of the products of combustion show the percentage of CO_2 to be very high, in some cases as high as 15.8 per cent. Mr. Collins reports tests where this value reached 17 per cent. The necessary excess air is small, only about 18 per cent., and at the very high temperatures reached the sulphur is also largely burned and carried off as SO_2.

In considering the quality of the steel produced, the following items enter: the control of the flame, not only chemically but also as to intensity, direction, shape, and velocity; the kind of coal used; its constituents other than carbon; the kind and amount of so-called impurities, moisture, volatiles, sulphur, and ash being the chief items. Each of these may affect the steel. The flame may be directed, lengthened, shortened, made oxidising or reducing as desired, and the temperature may be kept remarkably constant at any desired point within quite wide ranges.

Disadvantages of Pulverised Coal.

All of this leads to the belief that pulverised coal is an ideal fuel. For some uses this may be so, but we have not yet considered the third factor in open-hearth operation, namely, the cost of repairs and upkeep of the furnace and its accessories. It has been the author's experience at the Atlantic Steel Company that herein lie the greatest difficulties. The condition of the coal-fired furnace after 100 heats was found to be worse than the condition of a similar furnace, oil-fired, after 287 heats. The gas-fired furnaces suffer even less. In round numbers, the company have obtained about three times as many heats from their other furnaces as from the coal-fired furnace, where the refractories cut away, the slag pockets fill faster, and the chequers become choked.

It appears that the excess air carried along with the sweeping flame at the very high temperature attained so rapidly will attack and cut the refractories more than it does with either the oil or the gas flame. There are some who attribute the possible cause of the rapid cutting of the refractories by the coal flame to the presence of incandescent ash particles impinging at high temperature in conjunction with the highly heated excess air. This ash, it is supposed, may start some sort of slagging action, which lays the surface of the brick more open to the attack of the oxygen. Certain it is that the ash has a pronounced effect on the slag of the bath. But the chief source of annoyance and expense lies in the deposit of ash as slag in the slag pockets and in the chequers. This takes place rapidly, and the toughness of the deposited slag is pronounced. It has been found that a high stack velocity lessens this deposit materially; but this increase of stack velocity is obtained at the expense of several things. It calls for additional excess air to increase the volume of gases passing, so as to increase the velocity. This of course at once reduces the temperature of the flame, but at the same time it increases the cutting effect on the refractories. To carry off this extra volume of flue gas necessitated passing the gases from the chequers directly to the stack, cutting out the waste-heat boiler. This is, of course, another serious loss of heat energy. Attempts to use the waste-heat boiler reduced the flue-gas velocity so that the slag deposited rapidly, and the chequers became badly choked, which further reduced the gas velocity and caused a further drop in flame temperature, which in turn seemed to cause more sulphur to enter into combination in the steel.

Both the temperature and intensity, as well as the direction of the flame, had to be kept within certain limits to avoid sulphur troubles. It seems that the sulphur oxidises and passes of as SO_2 at and above certain temperatures. This is doubly advantageous, as the sulphur is not only disposed of but it generates heat in burning. When the temperature falls below this critical value, the sulphur prefers the iron to the oxygen and goes into the steel. To get rid of the sulphur the flame intensity should be high, the flame should not be depressed—that is, it should be directed above the bath, and the excess air must be adjusted within narrow limits. With insufficient excess air the sulphur is not oxidised; with too much the temperature drops, and again the sulphur is not oxidised. When these several adjustments are about right to effect a maximum removal of sulphur, the velocity of the gases is reduced to a point where the refractories are cut and the slag deposits heavily.

Cutting out the waste-heat boiler and increasing the excess air increases the flue-gas velocity and lessens the ash and slag deposit: but the refractories cut faster, the temperature of the flame drops, more sulphur enters the bath, and the use of the boiler is entirely lost.

The experience here recounted ran over a period of about seven years, 1916 to 1922, inclusive. These years were seriously affected by war conditions, both high and low peaks being reached. It has been difficult, therefore, to compile any fair set of data. But the conspicuous and interesting

fact is that both study and experience have clearly shown that the major objections to the use of pulverised coal in the open-hearth furnace lie not in the preparation nor in the burning of the coal, but almost entirely in that part of the work which coal-burning literature touches on so little or not at all, namely, the consequent clean-up, upkeep and repairs.

There is but one way to evaluate pulverised coal correctly as a fuel for the open-hearth furnace, and that is to watch the industry for a decade or two longer. With the ever-increasing improvements for taking care of difficulties as they present themselves, this type of fuel may come to be more and more used in open-hearth work. But at present the Atlantic Steel Company has just discarded its coal-fired furnace, because of the higher cost of producing steel by this means.

Comparative Costs of Operation with Pulverised Coal and Producer Gas.

In the table below will be found figures taken from data accumulated during 1922. This year was chosen as being most nearly representative, since prices of commodities and labour, and of production in general, were then somewhere about midway between the high peak of the war and the low peak of the intervening depression. These figures show actual costs, and these in turn why the pulverised-fuel method of operation was abandoned by the Atlantic Steel Company.

It is apparent from the figures in the table that the gas-made steel is both better and cheaper. It is also apparent that the chief objections to the use of pulverised coal lie in the difficulties engendered in the necessity of running the ash through as a part of the products of combustion.

	Pulverised coal.	Producer gas.†
COAL:		
Cost per ton (average)	$6.40 (26s. 4d. at par)	$6.40 (26s. 4d.)
,, per ton for milling	$0.62 (2s. 7d.)	$0.60 (2s. 6d.)
Lbs. of coal per ton of steel	636*	548
STEEL:		
Output in tons ..	2,068	2,016
Heats per furnace ..	42	39
Sulphur in steel ..	0.065 per cent.	0.045 per cent.
REPAIRS:		
Per month ..	$1,761 (£362)	$1,361 (£280)
Per ton of steel ..	$1.68 (7s.)	$0.96 (4s.)

Tennessee coal used, averaging 36 per cent. volatile, 53 per cent. fixed carbon, 3½ per cent. moisture, 6 per cent. ash, and 1½ per cent. sulphur. Dried at an average temperature of 200 deg. Fah., to about 1 per cent. moisture. Average pulverisation showing 98 per cent. passing 100-mesh screen and 81½ per cent. passing 200-mesh screen.

* Figure obtained by dividing total coal consumption by total steel output.

† Average for two gas-fired furnaces.

A report on "Pulverised-Coal Systems in America," by Leonard C. Harvey, published in London in 1919, shows that the Atlantic Steel Company is not alone in its findings as to the life of chequers. Under the heading "Opinions of Users" occurs the following statement: Have found the average life of chequers for various fuels in the open-hearth furnace to be: For natural gas, 1,000 heats; producer gas, 350 to 500 heats; oil, 350 to 500 heats; pulverised coal, 225 to 250 heats.

Pulverised Coal in Soaking Pits.

The Atlantic Steel Company is continuing its use of pulverised coal in the soaking pits, where the results are far more satisfactory than they were in the furnace, but are not so good as with producer gas. The slag and ash deposit, of course, takes place in the combustion chamber, in the soaking pit proper, and at the base of the stack. But this deposit is more readily removed and need never be allowed to accumulate sufficiently to choke the passages. The flame may be made either oxidising or reducing and, since the steel remains in the solid state, the sulphur gives no trouble. For soaking-pit operation the use of pulverised coal appears to be acceptable. The Atlantic Company have not used pulverised coal under boilers, except indirectly under the waste-heat boilers from the open-hearth furnace.

In spite of the promising outlook presented by the possibilities in the use of pulverised coal, in actual practice the use of this fuel in open-hearth operation proved at Atlanta, as elsewhere, to be unsatisfactory. Nor must it be forgotten that the trouble lay in that part of the operation which is not to be found merely in a study of fuel combustion. There is reason to hope and to believe that the near future will enable the open-hearth furnaces in small as well as large plants to use pulverised coal as a fuel. But before this can be done there must be some experimenting, and the smaller plants must await the results of these experiments, which only the larger plants can be expected to perform.

Contracts Open.

Adelaide, May 6.—Two 10-ton and one 15-ton travelling cranes, for the South Australian Harbours Board, Victoria Square, Adelaide.

Alnwick, January 31.—Weighbridge, to weigh up to three tons, for the Urban District Council. Mr. J. T. Robson, town surveyor, Alnwick.

Amble, January 29.—Providing and laying complete about 420 lineal yards of 3-in. cast-iron water mains with hydrants, stop valves, etc., for the Urban District Council. Mr. W. Burton, surveyor.

Boseili, Egypt, March 31.—Supply and erection of a pumping plant at Boseili, for the Ministry of Public Works, Egypt. The Inspecting Engineer, Egyptian and Sudan Governments, Queen Anne's Chambers, Westminster, S.W.1.

Girvan, January 30.—520 tons of cast-iron pipes and special castings of 8-in., 7-in., and 3-in. diameter, for the Town Council. Warren & Stuart, 94, Hope Street, Glasgow. (Fee, £2 2s., returnable.)

Girvan, Scotland, January 30.—Supplying, laying, jointing and testing of about six miles of cast-iron pipes of 8-in. and 7-in. diameter, together with the construction of two break-pressure tanks, etc., for the Town Council. Warren & Stuart, 94, Hope Street, Glasgow. (Fee, £2 2s., returnable.)

London, S.E., January 25.—Sluice gates for canal head regulator with 25-ft. gate spans, grooves, operating gear and cross bridge, for the Director-General, India Store Department, Branch No. 14, Belvedere Road, Lambeth, S.E.1.

London, S.E., January 25.—Locomotive axles and cast-iron pipes, for the Director-General, India Store Department, Branch No. 14, Belvedere Road, Lambeth, S.E.1.

London, S.W., February 8.—Points and crossings, for the South Indian Railway Company, 91, Petty France, Westminster, S.W.1. (Fee, 10s., non-returnable.)

Madras, February 27.—Cast-iron pipes, special castings, sluice valves, etc., for the Corporation of Madras. J. Mansergh & Sons, agents, 5, Victoria Street, Westminster, London, S.W.1. (Fee, 5s., non-returnable.)

Manchester, January 28.—Ventilating grids and other castings, for the Public Health Committee. Mr. J. Irvine, Public Health Department, Civic Buildings, 1, Mount Street, Manchester.

Manchester, February 4.—One locomotive jib crane and grab, for the Electricity Committee. Mr. C. Cradock, Committee secretary, Electricity Department, Town Hall, Manchester. (Fee, £1 1s., returnable.)

Richmond, Surrey, February 5.—80 tons of 9-in. and 7-in. diameter cast-iron pipes and special castings, for the Town Council. Mr. H. W. Apted, water engineer, Waterworks, Richmond.

Wentworth, N.S.W., March 10.—Two steam pile hammers, for the Department of Public Works, New South Wales (Water Supply and Sewerage Branch). Department of Overseas Trade.

MON. MASSON has been elected president of the Belgian Foundry Association in succession to Mon. Leonard. Mon. Masson is connected with the Fonderies des Chênée.

SMITH, PATTERSON & COMPANY, LIMITED, Pioneer Foundry, Haughs, Blaydon-on-Tyne, have now a sand slinger moulding machine in operation. Cochrane & Company, Limited, are installing a battery of sand-slinging machines, made by the Foundry Plant & Machinery Company, Limited, Glasgow. These are to be utilised in connection with the large order for tunnel segments recently secured by Messrs. Cochrane. Already one machine is in operation and producing segments, although Cochrane & Company have only had the order a little over 30 days. The lay-out provides for tractor sand slingers operating at a rate of 4 minutes per segment, and as 5 or 6 sand slingers will be functioning, it is estimated that segments will be produced at the rate of 1 to 1½ per working minute.

Sesto San Giovanni Works.

The Societa Anonima Acciaierie e Ferriere Lombarde (Lombardy Iron and Steel Works, Limited) has a share capital of 40,000,000 Italian lire (£1,600,000 at par), with registered offices in Milan, and owns and works eight iron and steel plants scattered over Lombardy. Three of these are at Sesto San Giovanni, one in Milan, two at Dongo, and the other two are known as the Vobarno Works and Arcore Works. Besides, in the Valtellina the Company has established two modern hydro-electric plants—Boffetto and Venina—which, by means of a transmission line about 76 miles long, feed the Sesto San Giovanni Works, and also works belonging to other concerns.

The Company employ altogether about 5,000 workmen and 350 clerks and foremen.

The most important plants of the Lombardy Iron & Steel Works are at Sesto S. Giovanni, some four miles from Milan.

Plant No. I.

This plant is connected with the main goods yard of the State Railways and itself comprises a network of about 13 miles of track. The trains are hauled by electric and steam locomotives.

The steelworks include four open-hearth furnaces of 30 to 45 tons, the waste heat from which is used for raising steam for the auxiliary plants, and five 3-phase electric furnaces of 15 tons each. The large quantity of scrap iron and steel used in the furnaces every day comes from an extensive dump served by travelling electric cranes fitted with electro-magnets for unloading wagons and loading the boxes for the electrical furnace chargers, which automatically pick up the loading boxes, introduce them into the furnaces, tip in their contents, and carry away the empty boxes ready for receiving new loads. The casting pit is served by five electric cranes, one of which has a capacity of 60 tons.

There are three rolling mills; one for large sections and rails, one for medium, and one for small sections. The three mills are driven by electric motors of 2,500, 1,350 and 800 h.p. respectively and equipped with all the necessary mechanical appliances for handling the ingots, etc., during and after rolling.

For heating the ingots continuous oil and coal furnaces are used with heat recuperation. All rolling mill operations and those for storing and loading the products on to wagons are effected by electric cranes both inside the buildings and in the stock yard.

There is a foundry for iron, steel and brass castings, with two large cupolas, three electric and some crucible furnaces. A reverberatory furnace is in course of construction. The foundry is specially equipped for casting rolls for the mills, ingot moulds, and, generally speaking, all the castings required by the steelworks and the rolling mills. A mechanical moulding plant is in use for repetition work. There are two furnaces for annealing steel castings, one of them with a travelling floor and oil firing. Four compressors supply compressed air for all auxiliary processes (sand-blasting, fettling tools, etc.), and blast for the cupolas, etc.

The machining shop is amply equipped with modern machine tools. Particularly worthy of note are:—(1) The Woodward machine for cutting helical gears, and the milling and planing of large pinions with straight or helical teeth, the whole being driven by electric motors; (2) a large facing lathe; (3) a planing machine with a table 10m. (33 ft.) long by 2½m. (8 ft.) wide. Other shops include one for mechanical and electrical repairs, a turning shop for rolls and a pattern shop.

FIG. 1.—OPEN-HEARTH FURNACES; SESTO SAN GIOVANNI WORKS.

There is a well-equipped chemical and physical laboratory and a test house with a universal machine for making tensile, compression and bending tests, etc., of a capacity of 100 tons, and another of 50 and 25 tons respectively, with the necessary apparatus for making shock and Brinell tests.

Plant No. II.

Plant No. II is the second in importance of the three at Sesto S. Giovanni, and has some three miles of standard-gauge railway track.

The shops for producing welded tubes began working in 1916 in five iron sheds with two gas producers. The gas produced by these feeds a heating furnace of the Siemens type, with a door at each end. The tubes are made from strip which is produced in other establishments of the Company, and is automatically fed into the furnace and carried to the welding bench. Then after passing through reeling and straightening machines, it is carried to the cooling floor. The semi-finished tubes pass to the finishing shop, where they are scraped, tested at 35 atmospheres

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(515 lbs. per sq. in.) and forwarded to the pickling vats. When this has been done by a machine which carries out the operations of scaling and washing the tubes, these are dried, dipped into a galvanising bath, whence they are automatically taken out and cooled. They then pass to the screw-cutting, etc., machines, and are finally checked, tied up in bundles, and placed in storage.

There are also two small universal mills for small

FIG. 2.—SCRAP YARD SHOWING TRAVELLING MAGNET CRANES, ETC., SESTO SAN GIOVANNI WORKS.

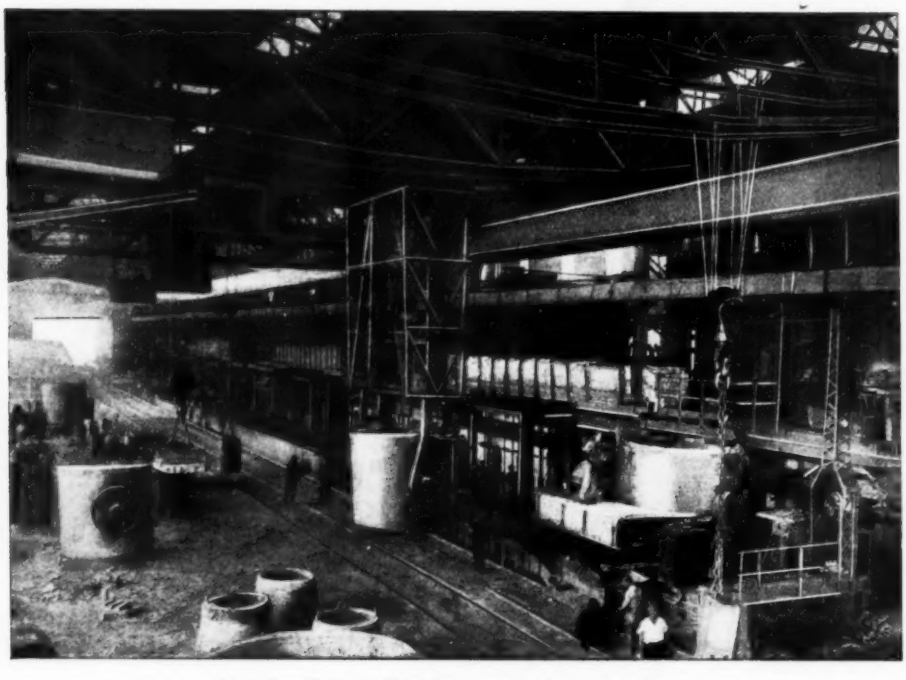

FIG. 3.—CASTING PIT; SESTO SAN GIOVANNI WORKS.

sections, two air compressors, a machine for bending tubes, hydraulic presses, accumulators, two 10-ton cranes, and one of 5 ton.

The rolling mills also began working in 1916; they are housed in eight large iron sheds. There are four gas producers with revolving grates and automatic clearing of cinders. They are situated in a lofty shed with bunkers and automatic hopper for feeding coal.

The heating furnaces are of the Siemens recuperative gas type. Two water-tube boilers, heated by the waste heat from the furnaces, supply steam for the producers.

The plate mill is a three-high mill with rolls of 900 mm. (35½ in.), with a fly wheel of 80 tons; it is driven by an electric motor of 2,500 h.p. The slab from the steelworks of No. I Plant, after being extracted by a machine from the reheating furnace, is deposited on rollers which carry it to the mill; lifting tables raise the slab, after passing between the lower and the middle rolls, to the necessary height to re-pass between the middle and the upper rolls. The turning and correct placing in position, first of the slab and then of the plate, are effected by means of mechanical manipulating gear. The plate runs still on rollers, through the straightening machine, and, when perfectly flat, reaches a chain transporter, where its cooling is accelerated, until it reaches an inspec-

tion table, which eventually turns it over like a huge page in a book, allowing of checking it for any defects on top and bottom.

After this, rolling tables carry the plates to a chain transporter, where they are turned off at right angles. After being marked the plate is carried, still on the roller table, after another deviation of 90 degrees, to three shearing machines, where it is cut to the required size, and after removing the small test pieces it is taken to the "weighing table" and the "unloading table." By means of magnet cranes the plate thus finished is passed on for inspection and loading for despatch.

The universal mill is a 650 mm. (25¾-in.) three-high mill with four vertical rolls and an 80-ton flywheel, and is driven by a 2,500-h.p. electric motor. The mechanical appliances of this mill are almost similar to those of the plate mill. The mill rolls large plates up to 30 m. (100 ft.) in length by one metre (39 in.) in width. This mill is also equipped for rolling sheets 2 m. × 1 m. (80 in. by 40 in.) and 2 mm. thick and chequer plates 4 mm. thick and over 1.25 m. (over 49 in.) wide.

There are large storehouses; a 40-ton crane and six of 10 tons; a hydraulic accumulator for supplying pressure water for raising the rolls and the furnace doors; air compressors for the pneumatic chisels and shears; and a furnace fired with pulverised coal for re-heating the plates and sheets.

The bolt-forging department began to function in 1917. It is housed in two sheds, one of which is of iron containing the forging presses, etc. The furnaces are fired with oil or coke. A reinforced concrete building contains all the screw-cutting machines for nuts, bolts, etc., and stores. The bars for this section come from the Company's own rolling mills.

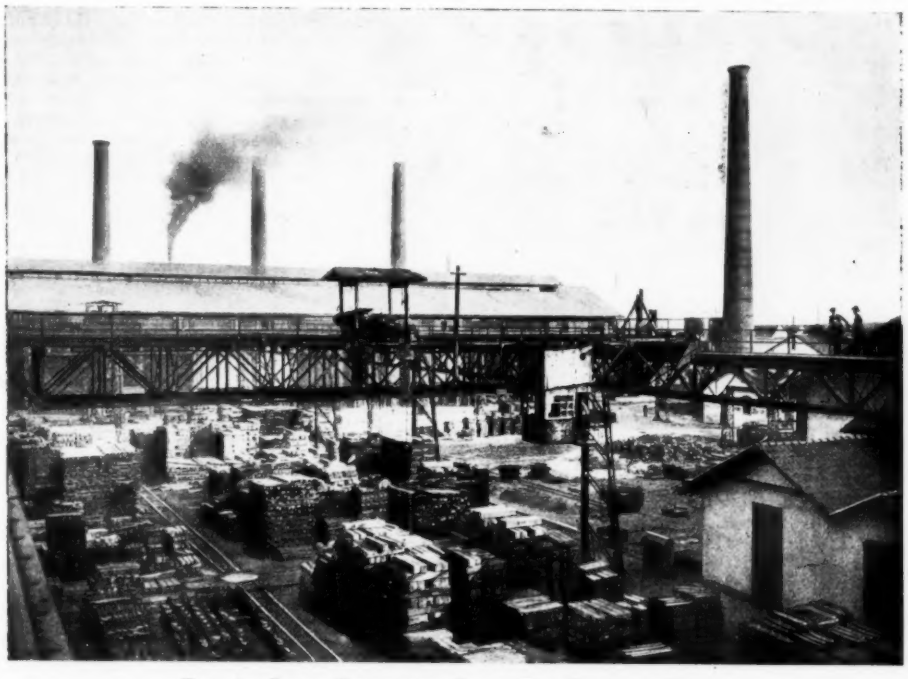

FIG. 4.—INGOT STOCKYARD; SESTO SAN GIOVANNI WORKS.

FIG. 5.—VIEW IN IRON FOUNDRY; SESTO SAN GIOVANNI WORKS.

The traction service is performed by steam locomotives and a battery loco. A huge water tower of reinforced concrete has lately been erected for feeding the two plants Nos. I and II.

Plant No. III.

Generally speaking, all the secondary processes in connection with the iron and steel goods produced by the Company are carried out at this Plant. The principal processes are: Wire-drawing, galvanising, making wire ropes, rolling cold strip, cutting and stamping, chains, cocks, etc.

In the wire mill there is a special section for thin wires of iron, steel, copper and other metals. The straightening machinery provided can turn out bars of a definite length up to 12 m. (40 ft.) of all diameters for reinforced concrete work, wheel spokes for bicycles, etc.

In the galvanising, etc., department there are three baths of different sizes for coating wire and other articles with tin, zinc, lead, etc.

The section for making wire ropes has 40 machines of all types and sizes. It can turn out cables, both of blank or galvanised steel wires, special cables, etc.

A machine for making wire netting with triple twist, turns out all kinds of netting up to 2.40 m. (8 ft.) in height. The netting is coated in the galvanising shop, which is fitted up according to approved modern methods.

Attached to the ropemaking section is a shop for making and tarring hemp, etc., cores for the wire ropes.

The cold-rolling shop supplies iron and steel sheets and strip of all qualities and sizes, from the thickest down to one-tenth of a mm. and even less, and up to 500 mm. (nearly 20 in.) in width.

The stamping shop is equipped with a series of presses for cutting and stamping any kind of goods from sheets prepared in the shop itself. Its output is most varied, ranging from small objects, such as washers, small bicycle chains, etc., to heavier chains for bridges, cranes and sluice doors.

In a substation the electric energy for motive power which is derived from the Company's own hydro-electric installations at 13,000 volts is stepped down to 500 and 200 volts.

Each shop is self-contained as far as the most urgent repairs and maintenance services are concerned, for each has its own machinery for the purpose.

Trade Talk.

G. & W. G. GUMMER, LIMITED, of Rotherham, have appointed Mr. J. T. Sherratt, of 84, Hatton Garden, E.C.1, as their London agent, in succession to Mr. L. Evans.

THE POLDI STEEL COMPANY (ENGLAND), LIMITED, have inspected a works' site, some 30 acres in extent, lying close to the Usk and near the Newport borough boundary.

NATIONAL GALVANISERS, LIMITED, of Sunderland; have appointed Hargreaves & Redfern, 19, Old Millgate, Manchester, as their agents in Lancashire and Yorkshire.

J. H. COLLIE & COMPANY, LIMITED, 8, Harrington Street, Liverpool, have been appointed agents for W. T. Glover & Company, Limited, of Trafford Park, Manchester.

THE PNEULEC MACHINE COMPANY, LIMITED, of Smethwick, are shortly doubling their capital to make provision for new lines of business in foundry specialities.

A LICENCE UNDER the Non-Ferrous Metal Industry Act, 1918, has been granted by the Board of Trade to Berry & Kennedy Metals, Limited, 110, Cannon Street, London, E.C.4.

PERRY & COMPANY (BOW), LIMITED, have secured the contract for the new General Post Office at Singapore, a building of reinforced concrete, which will cost about £1,000,000.

TWISS ELECTRIC TRANSMISSION, LIMITED, 3, Victoria Street, London, S.W.1, have established a branch at 24, Pearl Buildings, Newcastle-on-Tyne, under the management of Mr. G. P. Howkins.

BRUCE PEEBLES & COMPANY, LIMITED, engineers, Edinburgh, have appointed Sellar Inglis & Company, of 144, St. Vincent Street, Glasgow, as their agents for the West and North of Scotland.

AT A RECENT MEETING of the Manchester Geological and Mining Society, Mr. Clement Fletcher presiding, Professor O. T. Jones gave a lecture, illustrated by lantern slides, upon "Lead and Zinc Ores in the Slaty Rocks of Britain."

G. & J. WEIR, LIMITED, Holm Foundry, Cathcart, Glasgow, are now employing their ½-ton Greaves-Etchells furnace for the re-melting of Monel metal scrap.

DR. J. L. HAUGHTON gave a lecture at the Sheffield Metallurgical Chemists' Society's Rooms, West Street, Sheffield, last week, on "Measurements of Physical Properties of Metals."

RD. JOHNSON, CLAPHAM & MORRIS, LIMITED, have concentrated their stock at their new warehouse, etc., at Third Avenue, Trafford Park, Manchester. A part of the building in Lever Street will be maintained as a showroom.

A FIRE INVOLVING SOME DAMAGE occurred last week at the works of the Spartan Steel Company, Limited, Carlisle Street, Sheffield. The fire broke out in the laboratory, the contents of which were either destroyed or badly damaged.

THE MIDLAND MOTOR CYLINDER (ALUMINIUM) COMPANY, LIMITED, Dartmouth Road Foundries, Smethwick, are increasing the area of their foundries by the addition of a new bay, to cope with the greatly increased business in automobile cylinders.

THE SOUTH AUSTRALIAN GOVERNMENT has accepted the British tender for 600 gondola and 500 steel box railway cars. The American tender was for £1,027,000, including duty, insurance and freight, and was £92,000 lower than the lowest British offer and £288,000 less than the lowest Australian offer.

THE DIRECTORS of the Coltness Iron Company, Limited, have decided to terminate the company's financial year at December 31, instead of July 31, as in the past. A balance-sheet will be prepared for the five months to December 31, 1923, and submitted to a general meeting to be held towards the end of March.

MR. JOHN BELL, who is associated with Albert Smith & Company, foundry equipment specialists, 60, St. Enoch Square, Glasgow, has been appointed secretary of the Scottish Branch of the Institute of British Foundrymen, in place of Mr. W. H. Bound, who has joined the staff of Cochrane & Company, Limited, Middlesbrough.

THE HULL CORPORATION WATER COMMITTEE has accepted the tender of the Staveley Coal & Iron Company, Limited, Chesterfield, for 4,000 tons of cast-iron pipes. The contract price amounts to approximately £35,000. It is also proposed to seek sanction for the placing of a contract for new pumping plant to be installed at Dunswell, at an estimated cost of £90,000.

MR. G. H. JOHNSON, hitherto works' manager to the Kettering Iron and Coal Company, Limited, Kettering Furnaces, Kettering, has been appointed general manager of the company, in consequence of the death of the managing director, Mr. H. J. Preston, J.P., who had been connected with the company for about 45 years. Mr. George Barratt, who has been closely associated with the company for very many years, still holds the position of secretary.

A RECEIVER HAS BEEN appointed pending the reconstruction of the Park Royal Engineering Works, Limited, of Cumberland Avenue, London, N.W.8. The company, however, are still in a position to execute orders for switchgear, and their products generally, and among several recently secured contracts have orders for the main d.c. board at the power house at the British Empire Exhibition, Wembley.

ARRANGEMENTS HAVE BEEN made with the Railway Companies for exhibits to the British Empire Exhibition to be carried by goods or passenger train at half rates at owners' risk. Similar arrangements will apply to all unsold exhibits returning from Wembley at the close of the Exhibition. Certificates showing that the goods are actually intended for the British Empire Exhibition are being prepared, and these will be sent to exhibitors as soon as the Railway Clearing House has approved of their form.

VICKERS, LIMITED, of Barrow-in-Furness, have recently received an order from Japanese owners for two marine heavy oil engines of 600 b.h.p., to be repeats of the engine recently delivered to the order of their associates, Mitsubishi Shoji Kaisha, Limited, Cory Buildings, 117, Fenchurch Street, London, E.C.3. These engines are of the four-stroke cycle crosshead type with six cylinders 18¼ in. dia. by 27 in. stroke, and easily develop the required power at 150 r.p.m. The hydro-electric department of the company have received an order for a 25,000 h.p. water turbine, which will be installed at Calumet Island, on the Ottawa River, in Canada. The river falls 60 ft. at this point, and a power station is now under construction which will eventually house three units such as the above. This is in all respects the largest single runner Francis water turbine which has been built in England.

The Influence of Casting Temperature of Aluminium Alloys.*

By F. H. Hurren, A.I.C., M.Brit.F.

Although the founding of aluminium is in its early infancy, as compared with that of iron, this branch of the foundry trade occupies a very important position, and is now an industry of considerable dimensions. The automobile and aeroplane trade is largely responsible for the great strides made in the use of aluminium castings, and many important investigations have been undertaken and much useful information obtained. To a large extent foundrymen are indebted to the Light Alloys Research Committee for their scientific knowledge of aluminium alloys; but at the same time, useful work has been carried out by private individuals, and published in the technical journals.

In the foundry of the Rover Company the present average output of aluminium castings is just over 400 tons per annum, and this represents a very considerable number of individual articles. As different castings have to comply with different tests, some to a tensile test, some to a water-pressure test, some to an oil-pressure test, some to withstand vibration, and some to hold their strength at high temperature, it will be obvious that a measure of scientific control is essential. Analyses are regularly undertaken, but this does not go sufficiently far.

For some years now the author has been interested in casting temperature, which he considers to be of vital importance in the successful production of aluminium castings. Any average aluminium foundry worker knows that a casting which has been poured very hot has a yellow, or light brown, skin, instead of pure white. This is only an empirical test, and is being wise after the event. It is impossible to enunciate a hard-and-fast rule that all castings must be poured within a specific range of temperature, as the mass, thickness, type of alloy, and purpose to which the casting is to be put all demand consideration.

The author insists that for any one casting there is a short range of temperature at which the metal should be poured, to obtain the best results; and this temperature range can only be discovered by definite experiment in actual practice. One important point to bear in mind is that the composition of the alloy is also a determining factor in the consideration of casting temperature. It does not necessarily follow that a casting which gives good results when cast at a certain temperature in L5 alloy will give equally as good results at this temperature when a radical alteration is made in the composition of the alloy. Change begets change, and even a comparatively small change in the make-up of the metal charge will necessitate a certain amount of experimental work to determine the most suitable casting temperature for each job. Once a good casting has been produced, it is advisable to take note of all the variables which occur in production, and endeavour to standardise. Good results can be obtained, and have been obtained, by rule of thumb methods, but there is far more certainty with some kind of scientific control, yet scientific knowledge must be combined with a knowledge of foundry practice, and also a study of human nature.

Pouring Temperature the Governing Factor.

In a Paper which the author read in Birmingham in March, 1917, he stated that, "by attention to casting temperature, it does not matter what temperature the metal has attained, nor how long it has remained in the furnace, results may be obtained equalling those from metal which has been melted with every care."

This view was also taken by Rosenhain and Grogan in a Paper read before the Institute of Metals, and published in their "Journal," 1922, Vol. 2, although their experiments were conducted on commercially pure aluminium only. In the light of knowledge gained since 1917, and more especially during the last twelve months, the author is compelled somewhat to modify his views, which will be outlined later.

In determining the effect of casting temperature, one has also to consider many other factors which have, or may have, an important bearing on the results. For instance, there is the question of the maximum temperature the metal has attained in the furnace, and the length of time the molten metal has remained in the furnace before pouring. It is not always possible to use metal the moment it is melted, desirable as such a course may be, as delays in moulding may occur.

Effect of Ageing.

Then there is the effect of ageing, a subject on which a considerable amount of research has been carried out of late. This is a very important factor in production, as aluminium castings may not come into use as a finished article for some months after they have been produced. This particularly applies in the motor trade, where it is estimated a period of at least four months elapses between the actual casting of the article and its debut on the road as part of a finished car.

Effect of Internal Strain.

There is also the effect of internal strain, and this is one on which no measurable data are obtainable. Castings have been produced and carefully examined by two independent parties, placed in the stores without any rough handling, and found to have developed cracks some weeks later, owing apparently to internal stresses.

Experimental Conditions.

In the figures to be submitted the maximum temperature the metal has attained in the furnace is given, and, unless expressly stated to the contrary, the tests have been made on metal which has remained in the furnace not more than 20 minutes after actual melting. Later on, it is proposed to give some results obtained after ageing. All test bars have been either sand-cast or chill-cast, as stated, in parallel bars ½-in. dia. in the rough, and for tensile test turned down to 0.564 in. for 2 in. of parallel. All bars have been produced under actual working conditions, the metal being melted in the ordinary course of foundry practice, and the temperatures taken with a Foster base-metal couple immersed in the metal. This type of pyrometer is in constant use in the Rover Company's aluminium foundry, and the accuracy of the readings is checked periodically in the laboratory.

It is not claimed that the results given in this paper represent research of a high degree of scientific accuracy, but it is considered that they give some indication of what might be expected in the commercial production of aluminium castings, when foundry practice is allied with science. At the same time, it must be clearly understood that troubles in the foundry will still persist, unless good melting practice is coupled with good moulding practice. First-class metal poured into a third-class mould will only result in a second-class casting; just the same as a good mould will be spoiled by disregarding pouring temperature, or pouring with badly-melted metal.

Defects Encountered.

The most common troubles from which aluminium castings suffer are cracked and drawn places, porosity, fine pinholes visible on machined surfaces, sponginess, and blowholes. With the exception of the latter, these difficulties can be remedied by attention to melting practice, and paying due regard to the importance of casting temperature. Blowholes are generally due to faulty moulding practice, but may be attributable to excessive oxidation during melting.

* A Paper presented to a joint meeting of the Sheffield Branches of the Institute of British Foundrymen and the Institute of Metals, Mr. J. Shaw presiding.

Tests on L8 Metals.

Table I outlines tensile tests taken on what is usually known as L8 metal, an alloy of aluminium and copper, more often used for die-casting than for sand castings. These bars were sand-cast, and it will be noticed that the bar cast at the intermediate temperature, 700 deg. C., gives the best results, although both this and the bar cast at 600

TABLE I.—*Influence of Casting Temperature on Sand-cast L8 Alloy* (aluminium, 87.90; copper, 11.14; zinc, trace).

No.	Casting temperature in degs. Cent.	Max. stress. Tons per sq. in.
10	800	7.28
11	700	8.24
12	600	8.00

Maximum temperature in furnace, 960 deg. C.

deg. C. show a higher tensile than that obtained at 800 deg. C. All the results given in this Paper are the average of duplicate tests. It will be noticed also that the metal attained rather a high temperature in the furnace before withdrawal. This metal was melted in a small crucible furnace, and should have been withdrawn at about 800 deg. C., but the operator's attention was diverted for some few minutes, and during that time the temperature of the metal had increased to 960 deg. C.

Table II gives tensile tests on chill cast bars from the same material. It will be observed that the higher breaking stress is obtained in the bars cast at the lower temperature, and also that these bars show a small amount of elongation. In these

TABLE II.—*Influence of Casting Temperature on Chill-cast L8 Alloy.*

No.	Casting temperature. in degs. Cent.	Max. stress. Tons. per sq. in.	Elongation, per cent.
13	750	7.68	—
14	650	8.20	1.0

Maximum temperature in furnace, 960 deg. C.

bars, and in those in the previous table, no yield point was visible. The yield point, in all these results, is taken as the stress at which an extension of the gauge points commences.

Table III gives the results of some early experiments on the now well-known "Y" alloy. This is an alloy of aluminium, copper, nickel, and magnesium. The bars were sand cast, tested in the "as cast" condition, within 24 hours of casting, and not subjected to heat treatment. These

TABLE III.—*Influence of Casting Temperature on Sand-cast "Y" Alloy* (Al, 92.15; Cu, 3.44; Ni, 2.59; Mg, 1.37; and Fe, 0.45 per cent.).

No.	Casting temperature. in degs. Cent.	Max. stress. Tons. per sq. in.	Elongation, per cent.
15	800	10.96	0.5
16	700	10.76	1.0
17	625	9.80	—

Maximum temperature in furnace, 910 deg. C.

results are unique, being the only samples handled, in the course of several hundreds of tests, which give a decreasing tensile test with reduction of casting temperature. No yield point was visible. The bars cast at 800 deg. C. show results superior to those on the bars cast at 700 deg. C., and those cast at 625 deg. C. give the poorest results. In connection with "Y" alloy, there is distinct difficulty in casting at comparatively low temperatures. This difficulty is recognised by Rosenhain, who, in a paper presented to the Institute of Metals (Vol. 1, 1923), recommends a casting temperature of 750 deg. C., and also that the metal in the furnace should not be allowed to exceed 800 deg. C. At or about 625 deg. C. "Y" alloy becomes pasty, and then sets very rapidly.

Duplicate sets of these bars were heat-treated in an electric furnace for six hours at 520 deg. C. and quenched in boiling water. They were then allowed to age for 8 days at room temperature before testing, and the tensile results are given in Table IV. These figures show a reversal of order to those in Table III; the breaking stress now increases with decrease of casting temperature. It will be noticed that the increase is the same in each case, the bar cast at 700 deg. C. gives a breaking stress exactly the mean of the other two results. Only one bar shows any evidence of elongation. From a commercial point of view, the tensile results are very low, but it is regrettable to state that in the course of numerous experiments on "Y" alloy the author has never

TABLE IV.—*Influence of Casting Temperature on Heat-treated and aged "Y" Alloy Bars.*

No.	Casting temperature. in degs. Cent.	Max. stress. Tons. per sq. in.	Elongation, per cent.
15T.	800	6.56	—
16T.	700	7.40	—
17T.	625	8.24	0.5

Maximum temperature in furnace, 910 deg. C.

attained anything like the remarkably high figures published by the Light Alloys Research Committee.

Table V gives results on the same mixture but cast in chills. These follow what may be called constitutional practice, the bar cast at the lower

TABLE V.—*Influence of Casting Temperature on Chill-cast "Y" Alloy Bars.*

No.	Casting temperature. in degs. Cent.	Max. stress. Tons. per sq. in.	Elongation, per cent.
18	750	12.20	0.5
19	650	14.20	1.0

Maximum temperature in furnace, 910 deg. C.

temperature giving the best results. Duplicates of these bars were heat-treated, but unfortunately were badly distorted and useless for purposes of tensile test.

Effect of Soaking Aluminium Alloy.

The results of a double experiment are given in Table VI. A batch of metal was carefully melted, and a pot withdrawn from the furnace when it had reached a temperature of 770 deg. C. The metal was allowed to cool naturally, and test bars

TABLE VI.—*Influence of Soaking on the Tensile Properties of Aluminium Alloy Bars.*

No.	Casting Temp. in deg. C.	Y.P. tons per sq. in.	M.S. tons per sq. in.	E. per cent.
20	710	8.60	9.40	2.0
23	710	6.80	8.08	2.5
21	640	8.80	9.64	1.5
24	640	7.40	10.24	3.5
22	670	8.36	10.36	2.5
25	670	7.48	8.96	2.0

ANALYSES.

	Before soaking.	After soaking.
Aluminium	85.56	86.71
Copper	3.29	3.75
Zinc	12.18	8.92
Iron	0.73	0.42

cast in sand at 710 deg. C. and 640 deg. C., and in chills at 670 deg. C. These are the bars numbered 20, 21, and 22 respectively. The pot was then replaced in the furnace, coked up, and the metal left to soak for 1½ hours. During that time the maximum temperature reached by the metal was 1,110 deg. C. The pot was then drawn, allowed to cool, and test bars cast at the same temperatures as before, namely, in sand at 710 deg. C. and 640 deg. C., and in chills at 670 deg. C. The bars are those numbered 23, 24, and 25 respectively. Looking first at the results on the sand-cast bars, one could not say definitely that any harm was apparent; in fact, bar No. 24 gives a higher breaking stress and elongation than bar No. 21. With the chill cast bars there is a wider difference, and the results are in favour of the normally melted material. It will be observed that the analyses differ somewhat, the metal which has been "soaked" being lower in zinc, naturally increasing the aluminium and copper content. This is only to be expected, but one unexpected feature was a reduction in the iron content.

In the light of this, and many other experiments of a similar nature, the author was led to the belief that aluminium alloys suffered no ill-effects by over-heating, or "burning," provided due attention was paid to casting temperature.

Table VII gives evidence which has caused a modification of these views. Repeat impact tests on an Eden-Foster machine were carried out. For this test the bar is turned down to 0.5 in. dia., with a groove 0.05 in. wide turned down to 0.4 in. dia. The bar is placed on supports 4½ in. apart, and a 2-lb. hammer allowed to drop from a height

of 1 in. on to the grooved portion, the bar being turned round through 180 deg. after each blow. The total number of blows required to fracture the bar is recorded. Of the two bars cast at 710 deg. C., that cast first required 18,976 blows to fracture, whereas after overheating only 10,780 blows were required. Of the bars cast at 640 deg. C., that cast first stood 21,838 blows, but

TABLE VII.—*Repeat Impact Tests on Aluminium Alloy Bars Outlined in Table VI.*

No.	Casting temperature in deg. C.	Blows.
20	710	18,976
23	710	10,780
21	640	21,838
24	640	Defective bar.
22	670	22,458
25	670	19,034

no results could be obtained from the bars cast after overheating, as no less than three bars were found to be unsound on turning. Of the chill cast bars, 22,458 blows were required to fracture the normally melted metal, against 19,034 after overheating. It is worthy of note that once again the better results are obtained at the lower casting temperature, as evidenced by the fact that the normal bar cast at 640 deg. C. withstood nearly 3,000 more blows than the bar cast at 710 deg. C.

It is apparent, from these results, that aluminium alloys do suffer some ill-effects from prolonged overheating, although in this case the overheating was deliberate and excessive. Similar results have been obtained on repeat experiments of this nature, and, as in automobile work, aluminium alloys have to withstand severe vibration, this point is important. Tensile tests on overheated or "burnt" metal show little depreciation, but repeat impact tests generally give lower results.

More Tests on "Y" Alloy.

Some further experiments on "Y" alloy were undertaken, and the tensile test figures are given in Table VIII. All these bars were chill cast and aged at room temperature for 14 days before testing. It will be noticed that the bars cast at 760 deg. C. and 740 deg. C. have the same breaking

TABLE VIII.—*Influence of Casting Temperature on Chill-cast and aged "Y" Alloy Bars* (Al, 92.02; Cu, 3.77; Ni, 2.36; Mg, 1.44; and Fe, 0.40 per cent.).

No.	Casting temperature. in degs. Cent.	Max. stress. Tons. per sq. in.	Elongation, per cent.
30	760	11.60	—
31	740	11.60	0.5
33	700	11.92	0.5
35	625	13.68	0.5

Maximum temperature in furnace, 790 deg. C.

stress, but the second bar shows a slight elongation. There is a progressive rise in breaking stress with reduction of casting temperature, and the bars cast at 625 deg. C. show a considerable increase. Of five bars cast at this latter temperature, only two were sound, the other three having cold shuts. This is a common defect with "Y" alloy, which does not cast well below 650 deg. C. Results after heat treatment are not available, as one bar broke on the shoulder on testing, one was spoiled in turning, and the bars cast at the low temperature were unsound. The result on the only remaining bar is useless for comparison.

Repeat impact tests on bars in this series are given in Table IX. It will be noticed that in the "as cast" condition they show a progressive rise

TABLE IX.—*Repeat Impact Tests on "Y" Alloy.*

No	Casting Temperature in deg. C.	Blows as cast.	Heat treated.
32.	720	1222	42338
33.	700	1962	13126
34.	650	3862	15072

Maximum temperature in furnace 790 deg. C.

in resistance to fracture as casting temperature falls, but that heat treatment apparently so alters the structure that the effect of casting temperature is lost. Heat treatment causes a large increase in the number of blows necessary to fracture, particularly in the bars cast at 720 deg. C. This bears out the statement of the originators of this alloy, that a fairly high casting temperature is needed for satisfactory results to be obtained.

Influence of Temperature of Dies.

In the production of die castings, the temperature of the dies is an important factor for success. In Table X the first bar was cast in a chill at an approximate temperature of 500 deg. C., and the other bar in a chill at a temperature of 120 deg. C., the pouring temperature of the metal being the same in each instance. There is quite a

TABLE X.—*Influence of Temperature of Dies on Tensile Strength of Aluminium Alloy* (Al., 82.04; Cu., 3.39; Zn., 13.73; and Fe., 0.65 per cent.).

No.	Casting Temperature in deg. C.	Y.P. tons per sq. in.	M.S. tons per sq. in.	E. per cent.
2.	700	8.80	10.04	2.0
3.	700	9.04	11.40	3.0

Maximum temperature in furnace, 810 deg. C.

reasonable difference between the two results, and it is obvious that a quicker rate of cooling (chill effect) causes the higher tensile figures.

The effect of ageing is a very important factor. If castings improve with age, so much to the good; but it is very essential that material should not deteriorate with age.

Aluminium-Copper-Zinc Alloys.

In Table XI are some results on an aluminium-copper-zinc alloy. Two sets of bars were cast in chills at temperatures of 700 deg. C. and 640 deg. C. Tensile tests were taken 4, 45 and 95 days after

TABLE XI.—*Influence of Ageing on Aluminium-Copper-Zinc Alloys* (Al., 82.04; Cu., 3.39., Zn., 13.73; and Fe., 0.65 per cent.).

No.	No. of days aged.	Casting Temp. in deg. C.	Y.P. tons per sq. in.	M.S. tons per sq. in.	E. per cent.
3.	4	700	9.04	11.40	3.0
3A.	45	700	10.12	11.52	4.0
3B.	95	700	10.44	13.28	4.0
1.	4	640	8.84	11.44	4.0
1A.	45	640	10.48	13.84	4.0
1B.	95	640	10.12	13.72	4.0

Maximum temperature in furnace, 810 deg. C.

casting. It will be observed that the difference in tensile at the different temperatures is not very pronounced after 4 days' ageing, but becomes more marked after 45 days. A further period of ageing appears once again to eliminate the difference, yet both sets show a considerable improvement with age.

Table XII gives results due to ageing on an aluminium-copper alloy containing a small quan-

TABLE XII.—*Influence of Ageing on Alloy containing* Al., 85.32; Cu., 12.45; Zn., 1.63 per cent.; and Sn., Trace.

No.	No. of days aged.	Casting Temp. in deg. C.	Y.P. tons per sq. in.	M.S. tons per sq. in.	E. per cent.
6.	6	680	—	9.64	1.0
6A.	37	680	11.0	11.20	1.5

Maximum temperature in furnace, 710 deg. C.

tity of zinc. A delay of 31 days before testing gives considerably improved results.

Table XIII deals with a die-casting alloy of aluminium and copper. In this batch the bars cast at 800 deg. C. show a reduction in breaking stress with an increased elongation, whereas those cast at 700 deg. C. and 600 deg. C. show an in-

TABLE XIII.—*Influence of Ageing on a Die Casting Alloy containing* Al., 87.90; Cu., 11.14 per cent.; and Zn., Trace.

No.	No. of days aged.	Casting temp. in deg. C.	M.S. tons per sq. in.	E. per cent.
10.	3	800	7.28	—
10A.	35	800	6.64	1.0
11.	3	700	8.24	—
11A.	35	700	8.84	1.0
12.	3	600	8.00	—
12A.	35	600	8.36	1.0

Maximum temperature in furnace, 960 deg. C.

crease in breaking stress and elongation after 35 days' ageing. It will be noticed that the aged bars all show a small elongation, whilst the bars tested soon after casting show none. Both in this and the previous test it would have been desirable

to continue the ageing effect, but an insufficiency of test bars precluded this.

In Table XIV are another set of results on aluminium-copper-zinc alloys. These were sand-cast bars, and a peculiarity of the results is that, though both bars show an increase in breaking stress after 40 days' ageing, neither of the bars

TABLE XIV.—*Influence of Ageing on Sand-cast Bars containing* Al., 85.56; Cu., 3.29; Zn., 12.18; and Fe., 0.73 per cent.

No	No. of days aged.	Casting Temp. in deg. C.	Y.P. tons per sq. in.	M.S. tons per sq. in.	E. per cent.
20.	5	710	8.60	9.40	2.0
20A.	40	710	—	10.00	1.5
21.	5	640	8.80	9.64	1.5
21A.	40	640	—	11.44	1.5

Maximum temperature in furnace, 770 deg. C.

then gave any evidence of yield point. It will be noticed that both before and after ageing the general rule applies, *i.e.*, better tensile tests are obtained at the lower casting temperature.

Table XV gives figures obtained quite recently on a ternary alloy. An examination of this table shows that the yield point is much the same for all casting temperatures, but that both the breaking stress and elongation progressively increase as the casting temperature decreases. These tensile tests

TABLE XV.—*Influence of Casting Temperature on an alloy containing* Al., 82.78; Cu., 4.90; Zn., 11.50, and Fe., 0.60 per cent.

No.	Casting Temp. in deg. C.	Y.P. tons per sq. in.	M.S. tons per sq. in.	E. per cent.
40.	770	5.96	7.88	2.5
41.	700	6.40	8.84	4.0
42.	680	6.04	9.40	5.0
43.	660	6.44	11.04	6.0
44.	640	6.04	11.32	7.0

Maximum temperature in furnace, 770 deg. C.

were made within 48 hours of casting, and the bars were chill-cast. Duplicate bars of this series have been put aside for the purpose of ageing, and tensile tests will be taken at intervals of six months. Should the author have occasion to present a further Paper on this subject, he hopes to be able to include those results.

Further experiments on resistance to repeated impact are exhibited in Table XVI. The differences in the number of blows required to fracture are remarkable. The bar cast at 610 deg. C. needed nearly 8,000 more blows than the bar cast at 640 deg. C., and more than twice as many blows

TABLE XVI.—*Influence of Casting Temperature on Repeat Impact tests using an alloy containing* Al., 86.08; Cu., 2.95; Zn., 10.04; and Fe., 0.68 per cent.

No.	Casting temp. in deg. C.	Blows to fracture.
27.	710	12252
28	640	22998
29.	610	30768

Maximum temperature in furnace, 840 deg. C.

as the bar cast at 710 deg. C. This is truly a remarkable variation for a relatively small difference in casting temperature. Before passing from this table it should be noted that, as an experiment, a duplicate set of these bars were heat treated at 520 deg. C., and quenched in boiling water. On the repeat impact test, all broke outside the grooved portion. The bar cast at 710 deg. C. broke after 40 blows; that at 640 deg. C. after 72 blows; and that at 610 deg. C. after 478 blows.

Hardness of Aluminium Alloy.

Before concluding, it seems desirable to refer to hardness. This is not a very important function of aluminium castings, as aluminium is rarely used as a bearing metal, but there are occasions where a knowledge of the hardness is desirable. All the hardness determinations have been taken on a Brinell machine, with a load of 500 kilograms applied for 30 seconds. Flat strips, $\frac{3}{4}$ in. thick, were cast, and the Brinell number determined in several places. Repeat tests on the same samples were made at intervals, and as the results obtained are rather curious, it might be of interest to include some examples.

Table XVII gives the hardness on three sets of strips cast at 700, 650 and 585 deg. C. respectively. All were sand-cast. The Brinell number is given for each sample, tested immediately after casting, and also at various periods up to 85 days later. The first row shows that the bar cast at the lowest temperature is slightly harder than the other two. After 15 days there is a considerable increase in hardness in all three samples, and the hardness rises with reduction of casting temperature. This increase in hardness is maintained for a further 49 days, when there is another slight increase in the first two bars, bringing all three equal in hardness. No further change appears to take place, and it should be stated that these bars

TABLE XVII.—*Influence of casting Temperature on Aged Aluminium Alloy Bars on the Brinell Hardness* (500 *kgs.*)

Days Aged.	Cast at 700 deg. C.	650 deg. C.	585 deg. C.
1	50	50	54
15	63	65	70
29	63	67	70
36	63	67	70
64	70	70	70
85	70	70	70

Maximum temperature in furnace, 760 deg. C.

have been tested many times since at intervals of 14 days, but no change has taken place. The time factor has apparently eliminated variations due to difference in casting temperature.

Brinell hardness tests on die-casting alloy are given in Table XVIII. There is very little difference in the hardness when tested the day following casting, but all three samples show a reduction over a period of 36 days, and then a tendency to increase. Further tests made since this table was made out seem to indicate an arrest of change in the samples cast at 800 deg. C. and 600 deg. C.,

TABLE XVIII.—*Influence of Casting Temperature of Aged Die Casting Alloy on Brinell Hardness.*

Days Aged.	Cast at 800 deg. C.	700 deg. C.	600 deg. C.
1	70	73	70
8	65	73	65
36	63	65	57
57	73	77	65

Maximum temperature in furnace, 960 deg. C.

but another reduction of hardness in the sample cast at 700 deg. C. It is probable that, given sufficient time, the three samples will arrive at a stable state in which there is little or no difference in their respective hardnesses.

As a final batch of results, Table XIX gives hardness tests on "Y" alloy. These strips were cast at the same time as the tensile bars shown in Table III, and in dealing with the tensile tests

TABLE XIX.—*Influence of Casting Temperature of Aged "Y" Alloy on Brinell Hardness. Composition as shown in Table* III.

Days Aged.	Cast at 800 deg. C.	700 deg. C.	625 deg. C.
1	77	73	70
8	80	83	86
32	86	86	80
53	83	83	77
70	83	83	80

Maximum temperature in furnace, 910 deg. C.

it was stated that these were the only set of bars the author had tested in which the higher casting temperature gave the higher tensile. As is shown, the hardness results exhibit the same phenomenon. There was no possibility of the bars being mixed during casting, as each set were stamped immediately they were made. There appears a regular increase in the hardness over a period of 32 days, when it reaches its maximum; then there is a slight decrease until a stable state is attained, after which there appears to be practically no change. Further tests on these bars, made several months later, gave identically the same figures. The bar cast at 625 deg. C. shows rather erratic results, but this is mainly due to unsoundness. As stated before, it is exceedingly difficult to cast good test bars in "Y" alloy at temperatures below 650 deg. C.

CONCLUSION.

These results are typical of many others recorded over a number of years. The conclu-

sions drawn can now be stated. In the author's opinion, casting temperature has a profound effect on the physical properties of aluminium alloys, as typified by tensile strength, hardness and resistance to repeated impact.

All classes of aluminium alloys follow the same course, namely, the lower the casting temperature, the better the physical properties.

The difference in tensile strength due to variation in casting temperature persists on ageing, with the possible exception that with certain alloys of aluminium, copper and zinc, the difference appears to be less accentuated after ageing. As the author is engaged on further tests on this particular class of alloy, he does not feel justified in committing himself to a definite opinion on this point.

Hardness is also affected by casting temperature in the same manner as tensile strength, but in many instances ageing would appear to eliminate such differences.

Resistance to repeated impact is similarly affected by casting temperature, and in this property its influence is very marked. A reduction of 20 or 30 deg. causes an increase of approximately 50 per cent. in the number of blows required to fracture.

Prolonged heating in the furnace has apparently only a slight effect on the tensile strength, but a much greater influence on the resistance to repeat impact. This is no doubt due to the presence of oxide inclusions, as can be shown by examining unetched micrographs at 75 dias. In the ordinary coke-fired pit furnace, it is impossible to avoid an oxidising atmosphere, but in many types of gas-fired furnaces the mixture of gas and air can be so regulated that the bulk of the metal is in contact with a reducing atmosphere. Nevertheless, the difference between normally-melted and overheated metal can be detected by the repeat impact test. Overheating is never indulged in as a regular practice, but may be the accident of the moment. It has nothing to recommend it; it is wasteful of fuel and metal; and the aim of every foundry foreman should be moulds ready for the metal, rather than metal ready for the moulds.

For the production of good castings in aluminium alloys, a mould should be poured at the lowest temperature at which a sharp casting is obtained; a better practice would be to determine by the aid of a pyrometer the exact casting temperature at which the best results are obtainable for each type of casting, and standardise the use of the pyrometer as part of the regular routine of the shop.

With competition as it is to-day, and the greater demands for quality made on the foundry, chance methods of working may carry on for a time, but are likely to lead ultimately to the Bankruptcy Court.

The figures submitted, although they represent tests made at odd periods during the past seven years, touch only the fringe of the subject. The alloys of aluminium offer a wide field to the investigator, and though much has been made known, considerably more has yet to be discovered. There is no finality in metallurgical work, perfection will come with the millenium, and it is towards that happy state we must ever keep striving. Knowledge is mainly garnered in the hard school of experience, and the pleasure derived in the acquisition of such knowledge is often the only reward.

The British Cast-Iron Research Association.

A Director and a Consulting Metallurgical Engineer Appointed.

As previously announced, the Council of the British Cast Iron Research Association has appointed Mr. J. G. Pearce to the post of Director, in succession to Dr. Percy Longmuir.

Mr. Pearce received his training at, and is a graduate of, the University of Birmingham, and subsequently went through an apprenticeship course at the works of the British Westinghouse Electrical and Manufacturing Company, Manchester, now known as the Metropolitan-Vickers Electrical Company. He has been associated with Mr. A. P. M. Fleming, C.B.E., in the development of the research department of this concern, now recognised as one of the largest and most successful organisations of its type in the United Kingdom. Since its inception Mr. Pearce has been a member of Council and of various committees and chairman of the Publications Committee of the British Non-Ferrous Metals Research Association, one of the most active Research Associations.

Jointly with Mr. Fleming, Mr. Pearce has written "Research in Industry," a recently published study of the conduct of scientific research and its utilisation in industrial processes. During a large part of 1923 he visited the United States and Canada, spending a considerable time in the Pittsburgh area, and he has also travelled extensively on the Continent.

The new Director will take up his duties on February 1.

Mr. J. E. Fletcher, M.I.Mech.E., who has been appointed Consultant to the Association, will take special care of the practical side of cast and malleable iron research, and will deal with the problems directly associated with the practice of members.

MR. J. G. PEARCE.

He has had a lifelong experience of and connection with iron and steel foundry matters, blast furnace design, and smelting practice. In Sheffield he was for a number of years foundry manager in the works of Messrs. Thos. Firth & Sons, Limited, and Cammell, Laird & Company, Limited. He has had varied experience in the development of manufacturing methods, treatment and works research as applied to cast iron, steel and malleable cast iron.

Mr. Fletcher has specialised in the departments of the design of castings and moulding sands, as developed in actual engineering and foundry practice. His work in such directions has been brought to the notice of the metallurgical world in the form of numerous Papers read before the leading institutions.

As consulting metallurgical engineer to Messrs. N. Hingley & Son, Ltd., Netherton Ironworks, Dudley, and allied firms, Mr. Fletcher is in direct touch with all technical matters connected with the pig-iron, steel, wrought iron, malleable and grey iron foundry industries.

CONSIDERABLE DAMAGE was caused by a fire which recently broke out at August's Muffle Furnaces, Limited, Thorntree Works, near Halifax.

Empire Mining and Metallurgical Congress.

As a result of discussions between the Councils of the following bodies, it has been decided, as previously announced, to convene an Empire Mining and Metallurgical Congress to be held in London in connection with the British Empire Exhibition:—

The Institution of Mining and Metallurgy (mining of minerals other than coal and production of metals other than iron and steel);

The Institution of Mining Engineers (coal-mining engineering);

The Institution of Petroleum Technologists;

The Iron and Steel Institute;

The Institute of Metals, representing the scientific and technical interests of the mineral and metal industries; with

The Mining Association of Great Britain, and

The National Federation of Iron and Steel Manufacturers, representing the colliery proprietors and iron and steel manufacturers respectively, of the United Kingdom.

An Executive Committee has been constituted by these bodies to organise the Congress, and to invite the co-operation of the sister Institutions in the Dominions and India.

Recognising the importance of any movement which has for its object the advancement of the industries concerned with the development of the mineral resources of the Empire and the strengthening of the bonds which unite the organisations constituted for this purpose, the following official personages have given their approval and active support of the Congress by becoming Honorary Vice-Presidents:—The Secretary of State for the Colonies, the Secretary of State for India, the Secretary for Mines, the Prime Ministers of Canada, Australia, New Zealand, Newfoundland and South Africa, the Lord Mayor of London, the High Commissioners for Canada, Australia, South Africa, New Zealand, Newfoundland, and British India.

Objects of the Congress.

The Congress has for its chief objects:—

(*a*) The discussion of Papers dealing with the scientific, technical, and economic problems connected with the development of the mineral resources of the Empire, and the mining and metallurgical industries.

(*b*) The constitution of an Empire Council of Mining and Metallurgical Engineering Institutions, whose principal functions would be:—

(1) To serve as an organ of intercommunication between the co-operating institutions, and to promote the interests of the professions and industries.

(2) To create and maintain throughout the Empire a high standard of technical efficiency and professional status.

(3) To convene successive Congresses within the Empire.

(4) To establish, if it be found after discussion by the Empire Council and the co-operating institutions to be necessary or desirable, a "Register of British Mining and Metallurgical Engineers."

Outline Programme.

The Congress will be held at the British Empire Exhibition on Tuesday, Wednesday, Thursday and Friday, June 3, 4, 5 and 6, 1924.

The Viscount Long of Wraxall, President, will preside over the main sessions and at the official banquet, which, it is hoped, will be held, by the courtesy of the Corporation of the City of London, at the Guildhall.

The President will deliver as his address from the chair "The Sir Julius Wernher Memorial Lecture," and he will take as his subject "Mineral Resources and Their Relation to the Prosperity and Development of the Empire."

The Papers accepted for discussion (a list of which will be issued later) will then be presented and remitted for discussion by the appropriate sections.

The opening session on June 3 will adjourn about 1 o'clock p.m., and after the luncheon interval, official visits will be paid to the mineral exhibits of the Dominions, India and the Crown Colonies, and to the model colliery and coal-mining industry exhibit organised and erected by the Mining Association of Great Britain, with the co-operation of representatives of the Institution of Mining Engineers, the Miners' Federation of Great Britain, and the Mines Department of the Board of Trade.

Members of the Congress and their ladies will afterwards meet in the banquetting hall or other building in the Exhibition grounds, where tea will be served.

The several sections will meet in the conference halls allocated to them, morning and afternoon, on Wednesday, June 4, and Thursday, June 5, for the reading and discussion of Papers.

In the evening of Wednesday, June 4, the "May Lecture" of the Institute of Metals will be delivered by Dr. F. W. Aston, F.R.S., whose subject will be "Atoms and Isotopes." The same evening members and their ladies will be invited by the Rector of the Imperial College of Science and Technology, Sir Thomas H. Holland, K.C.S.I., K.C.I.E., and Lady Holland, to a reception at the Royal School of Mines, for which a programme of special interest will be arranged.

The official banquet will be held in the evening of Thursday, June 5, at 7.30 p.m.

The closing session of the Congress will be held at the Exhibition in the forenoon of Friday, June 6, for the consideration of resolutions and other business, and in the afternoon a reception will be held, particulars of which will be announced later.

Membership of the Congress.

Members of the seven convening bodies are eligible for membership of the Congress, and members of the sister Institutions in the Dominions and India are cordially invited to attend. The Canadian Institute of Mining and Metallurgy, the Australasian Institute of Mining and Metallurgy, the Chemical, Metallurgical and Mining Society of South Africa, the South African Institution of Engineers, and the Mining and Geological Institute of India have been invited to send official delegates to the Congress.

It is also hoped that the Ministers of Mines throughout the Empire will be represented by official delegates. An invitation has been extended to the United States Bureau of Mines at Washington, the American Institute of Mining and Metallurgical Engineers, and the Mining and Metallurgical Society of America to send official representatives in view of the fact that these bodies are already actively co-operating with some of the convening bodies by the exchange of information and results of researches into various common problems.

It has been decided that there shall be no fees payable for membership of the Congress, but members of the Technical Institutions are invited to contribute sums of £1 1s. or more to the Congress Expenses Fund. Corporate bodies and individuals associated with the mineral and metal industries are invited to contribute to a guarantee fund

Those intending to take part in the Congress are requested to notify their intention as soon as possible, especially members of the convening bodies who are resident in the United Kingdom.

An Appeal.

It is estimated that a sum of £10,000 will be required to defray the cost of printing and publication of Papers and discussions, and the entertainment of official delegates, members of the Congress from overseas, and other guests, etc. Up to the present the convening bodies have promised donations from their corporate funds aggregating £1,300.

In view of the imperial character of the Congress, the convening bodies earnestly request the individual members of the technical institutions to contribute donations of £1 1s. and upwards. Corporate bodies and individuals associated with the mineral and metal industries are invited to contribute £50 or upwards to a guarantee fund. The organising officers are acting in an honorary capacity, and the whole of the funds subscribed will be devoted to the work of the Congress, apart from the small expenditure required for the necessary clerical assistance. Subscriptions should be sent to Mr Charles McDermid, Cleveland House, 225, City Road, London, E.C.1.

XUM

IRON AND STEEL MARKETS.

Pig-iron.

MIDDLESBROUGH. — Business in the Cleveland iron market during the current week has naturally been adversely affected by both political and industrial developments, the stoppage of rail transport seriously interfering with deliveries, while the prospective advent of a Socialistic Government being regarded as anything but welcome at a moment when trade is at last showing signs of a revival. Quite apart, however, from these factors, a renewal of Continental competition in pig-iron is a further cause of weakness in Cleveland prices, the collapse of the French exchanges greatly facilitating the foreign invasion of the British home and export markets, and rendering the whole position exceedingly difficult and uncertain. Consequently there has been little new business offering this week at Tees-side, with No. 3 G.M.B. at 99s., though in one or two cases makers held firmly for another sixpence, with No. 1 again a shade weaker at 101s., No. 4 foundry 96s., and No. 4 forge at about 95s. per ton.

In the hematite market also business is quiet. Conditions, however, are regarded as only temporary as far as the home trade is concerned, makers' order books mostly well covering requirements over the first quarter, with prices fairly firm at 102s. 6d. per ton for East Coast mixed numbers, No. 1 quality realising 1s. per ton extra. In the West Cumberland and North Lancashire area there is little doing as regards export trade, though occasionally there are shipments to Italy and Germany, but South Wales buyers are few. But home users, save those here, are buying more cautiously, and in small lots, trade, in fact, being almost entirely of a hand-to-mouth character. Prices, nevertheless, remain firm, Bessemer mixed numbers being quoted at £5 15s. per ton delivered at Glasgow and Sheffield, and £6 at Birmingham.

MANCHESTER.—Buying in this market is still on a restricted scale, consumers of foundry pig having in many instances already covered requirements up to the end of March, and is reported that orders can be readily placed for Derbyshire No. 3 on a basis of 95s. per ton at furnace. There are, however, still one or two Derbyshire furnaces who decline to sell No. 3 iron at less than 96s. 6d. per ton on trucks. North Lincolnshire foundry iron is offered at 95s., but the carriage is higher to Manchester, and founders who prefer a little Lincolnshire for blending purposes have to pay 104s. per ton delivered in Manchester.

SCOTLAND.—Movements in the Scotch pig-iron market indicate a somewhat easier tendency in prices, the quotation for No. 3 quality now ruling at 106s. 6d. per ton at the furnace. Meantime, although there is a lack of new business, the makers all report that the iron sold is being well taken up, and, of course, the sooner purchases are exhausted the sooner will buyers be in the market again. The absence of more extensive buying is attributed principally to the cheap offers which are coming into the market daily from the Continent.

THE MIDLANDS.—Inquiries for pig-iron supplies at last week's Birmingham market disclosed a more cautious attitude on the part of buyers than has previously been noted, and business was consequently restricted in volume. There is still a fair demand for foundry iron, with prices firm at last week's figures, although many consumers anticipate some slight easing of values during the next few weeks owing probably to hopes of increased imports of foreign pig, following the recent slump in the franc. Ruling prices of pig-iron, f.o.t. furnace, may be quoted as follow:—Derbyshire No. 3 foundry, 95s.; Staffordshire No. 3 foundry, 95s.; Northants No. 3 foundry, 93s. 6d.

Finished Iron.

Fairly satisfactory conditions can be reported in the manufacturing industries of the trade, a considerable number of fresh contracts for material having been placed of late in connection with various developments in engineering and railway work, to which previous reference has been made. Foreign competition is, however, on an increasing scale in connection with the commoner grades of bars, and while South Staffordshire makers of nut and bolt bars are struggling to get the price up to £11 5s., Belgian bars of corresponding quality are being offered at a price which works out at £8 10s. to £8 11s., delivered. Makers of better quality iron are in a much more optimistic frame of mind, because they are looking forward to a considerable amount of work, especially in connection with the wagon orders. Their price consequently is very firm at a basis of £12 10s. for crown bars. The maintenance of the marked bar basis is regarded as a favourable indication of prevailing conditions.

Steel.

The position in the steel trade is again disturbed by a renewal of Continental competition, more especially as applies to semi qualities, in which severe undercutting of prices is experienced. In the Midlands and the North quotations for soft steel billets have eased to about £8 5s. British consumers, however, are awkwardly placed in regard to this material, as deliveries are very much delayed and those for the future are very uncertain. When it is remembered that quite a large number of orders have lately been placed on the Continent for substantial tonnages, all of which is required for prompt use, the difficulties of consumers on this side can be readily gauged. Although business in ferro-manganese is of a comparatively unimportant character, there is still a fairly steady demand on home account at unchanged prices. The export trade is, however, particularly poor, and very little is doing with America. The political situation at home, the constant alterations in the Continental exchanges, and the falling value of the sterling in New York, and the high price of tin, are tending to cause uncertainty in the tinplate trade. Meanwhile the market remains very steady, though quiet.

Scrap.

Reports from the chief centres of trade in scrap material are somewhat varied in tone, for while business on Tees-side is dull, some improvement may be noted in the Lancashire area as regards certain descriptions, with the exception of cast-iron, local dealers finding a difficulty in getting more than 85s. to 87s. 6d. per ton for the common qualities, and 95s. is the highest yet paid for fine broken machinery metal, although in Yorkshire up to 100s. per ton has been paid. The more encouraging outlook in the Yorkshire steel trade has brought an early renewal of activity in the scarp market, and fairly heavy business is being done both in iron and steel material. It is almost impossible to secure heavy basic steel scrap for melting at less than 100s. per ton, delivered Sheffield works. With the cheap Continental pig-iron which is being offered at Glasgow, the Scottish demand for cast-iron scrap of all descriptions has gone off considerably, especially in the Falkirk district, where the carriage on Continental material ex-Grangemouth is very small. However, there is, of course, a number of works who will not use Continental pig on account of the uncertainty of the quality, and in these cases Scotch iron and cast-iron scrap are still in demand here.

Heavy machinery metal runs about 102s. 6d. to 105s., and ordinary cast-iron scrap 95s. It is quite probable, however, that these prices will be reduced somewhat in the next few days. Light metal and furnace firebars run about 72s. 6d. per ton.

Metals.

Copper.—Standard values during the past week have been fairly well maintained, the range of quotations varying only to a fractional extent from day to day. Home consumptive demand continues steady, while American and European requirements are below the average for this period of the year. Evidently the question of over-production in North and South America combined continues to be regarded as the main disturbing factor, inasmuch as the United States refinery production for the past month was reported at about 100,000 tons, on the basis of which there would have been doubtless a renewed increase in the unsold stocks. Unless American buying revives to a good extent, and thus permits of the surplus being lightened again, New York prices are not unlikely to be kept down under keen competition. Current quotations:—*Cash*: Thursday, £60 7s. 6d.; Friday, £60 12s. 6d.; Monday, £61 7s. 6d.; Tuesday, £62 2s. 6d.; Wednesday, £62 2s. 6d. *Three Months*: Thursday, £61 2s. 6d.; Friday, £61 5s.; Monday, £62 2s. 6d.; Tuesday, £62 17s. 6d.; Wednesday, £62 17s. 6d.

Tin.—Although buying in the standard tin market of late has been on a more moderate scale, there continues a considerable undercurrent of strength in values, it being generally recognised that the statistical position of the metal is steadily improving. The general trade demand continues good, and considerable lines of Straits tin afloat or for January shipment to America have been handled through London at prices ranging up to about £248. With the home warehouse stocks reduced to a further extent, the market for cash and near delivery has assumed a more stringent aspect, and the contango on forward metal may be levelled down further in the near future. Current quotations:—*Cash*: Thursday, £248 15s.; Friday, £250; Monday, £252 2s. 6d.; Tuesday, £250; Wednesday, £254. *Three Months*: Thursday, £250; Friday,

£251 10s.; Monday, £253 7s. 6d.; Tuesday, £251 10s.; Wednesday, £255 5s.

Spelter.—Active dealings in this metal of late been on an unusually heavy scale, with prices inclining to higher values. The aspect of the market has been affected by the fact that c.i.f. costs for American spelter went up recently a good deal as a result of the sharp fall in the dollar rate of sterling, which made American sales virtually impossible. The disparity between America and this market, however, is not so wide as it was after the recent rise on this side, and anything like an important rally in the exchange would doubtless facilitate new buying from America. Current quotations:—*Ordinary*: Thursday, £35 5s.; Friday, £35 7s. 6d.; Monday, £35 12s. 6d.; Tuesday, £35 17s. 6d.; Wednesday, £35 17s. 6d.

Lead.—The market for soft foreign pig evidences continued activity, with values still on the up-grade. Fresh buying on the part of consumers remains quiet, but, on the whole, consumption is well sustained, and seems likely to expand as the year advances. The future of this metal, therefore, is regarded with confidence, and, in fact, the only adverse feature would appear to be the present high price. Stocks of lead on January 1 are given at 1,183 tons, a decrease of 50 tons on the month. Current quotations:—*Soft foreign* (*prompt*): Thursday, £32 2s. 6d.; Friday, £32 1s. 3d.; Monday, £32 2s. 6d.; Tuesday, £32 2s. 6d.; Wednesday, £32 5s.

Gazette.

THE YUKON ENGINEERING COMPANY, LIMITED, are being wound up voluntarily, with Mr. C. L. Sixsmith, 6, Broad Street Place, London, E.C.2, as liquidator.

THE HERTFORD ENGINEERING COMPANY, LIMITED, are being wound up voluntarily. Mr. E. Bishop, 22, Walbrook, London, E.C.4, has been appointed liquidator.

MESSRS. T. DUCKNEY and H. SUTCLIFFE, pattern and model makers, Akeds Road, Halifax, trading under the style of Duckney & Sutcliffe, have dissolved partnership.

THE LAST DAY for receiving proofs in connection with a dividend to be paid by the A.E.G. Electrical Company of South Africa, Limited, 6, Old Jewry, London, E.C., is January 31.

MR. HENRY REES, Official Receiver, Government Buildings, St. Mary's Street, Swansea, has been appointed liquidator of the Villiers Spelter Company, Limited, Villiers Spelter Works, Llansamlet, Glam.

MESSRS. F. F. AKROYD and T. E. KAY, carrying on the business of engineers, millwrights, etc., under the style of the Akroyd Machine & Construction Company, Back Archer Street, Halifax, have dissolved partnership.

MR. F. L. VARTY, brass and iron founder, Royston, carrying on business with his brother, Mr. T. Varty, as brass and iron founders and mechanical engineers at Royston, under the style of Varty & Sons, attended at the Cambridge Bankruptcy Court recently for his public examination in bankruptcy. Mr. F. L. Varty, replying to the Official Receiver, said the statement of affairs showed that the liabilities expected to rank amounted to £1,211, and the net assets to £977, leaving a deficiency of £233. The business was started by his father in 1873, and his brother and he worked for their father up to the time of his death in 1888. When his father died there was £1,000 owing to the bank. They had always been short of cash. His brother and he had no capital apart from what their father left them. They did not know the actual state of the business at the time they took it over. Witness had the conduct of the business, his brother having been an invalid for years. Some years ago he invented a patent fire bar. The making of these bars had been the principal part of their business for some years, and the turnover in respect of them was about £1,500 per annum. The patent run out some years ago. On the application of the Official Receiver the examination was adjourned.

International Foundry Trades Exhibition.

The Council of the Birmingham Chamber of Commerce has again undertaken the organisation of a foundry exhibition, to be held in Bingley Hall from June 19 to June 28, 1924. The patronage of the Institute of British Foundrymen and the British Cast-Iron Research Association has been accorded. The arrangements are being carried out by Mr. C. Stanley, the general manager of the Exhibitions Department of the Birmingham Chamber of Commerce. His address is 95, New Street, Birmingham.

Obituary.

MR. C. F. WILSON, of C. F. Wilson & Company, Links Engineering Works, Aberdeen, died recently.

MR. A. W. MACAULAY, technical manager of the Skefko Ball Bearing Company, Limited, of Luton, died recently.

MR. W. MEADOWCROFT, of C. H. Meadowcroft & Brother, Church Street, Brass Works, Dukinfield, died recently.

MR. G. SCOTT, managing director of William Patterson, Limited, of the City Wire Works, Newcastle-on-Tyne, died recently.

MR. A. P. MAIN, a director of Glover & Main, Limited, and Thos. Glover & Company, Limited, gas meter manufacturers, died recently in his 66th year.

MR. ROBERT HUNTER, of Walker, Hunter & Company, Limited, ironfounders, Falkirk, died on January 11 at his residence, Kirkmailing, Larbert. Mr. Hunter, who was in his 80th year, was, prior to his association with the company of which he ultimately became head, in the service of the Carron Company for 21 years. He was a well-known figure in Scottish ironfounding circles, and for some time occupied the position of chairman of the Falkirk and District Ironfounders' Association.

Personal.

MR. T. V. MILES, general manager of Newton, Chambers & Company, Limited, Thorncliffe Ironworks, has been elected chairman of the Wortley Rural District Council.

MR. A. H. NEWSUM has been appointed representative of the Fordath Engineering Company, Limited, Hamblet Works, West Bromwich, in the London area, for "Glyso" core oil compounds.

MR. J. E. MCLURG, general manager of the Halifax Shipyards, Limited, has been elected vice-president of the British Empire Steel Corporation, Limited, in succession to Mr. D. H. McDougall, who retired some time ago.

Correspondence.

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

Trade in Russia.

(TO THE EDITOR OF THE FOUNDRY TRADE JOURNAL.)

SIR,—Legislation permitting, the patenting of inventions in Russia under the new *régime* is now in a fair way to being consummated, and the registration of trade marks may, it is hoped, after reciprocal treaties have been concluded, follow subsequently.

British patentees and manufacturers are advised to be early in the field to secure priority and thus protect their rights against infringement. The possession of a patent or trade mark is not only a valuable asset to a business goodwill, but early protection is a necessary forerunner to the opening up of trade relations and the safeguarding of industrial rights therein.—Yours, etc.,

KING'S PATENT AGENCY, LIMITED.

146A, Queen Victoria Street, London, E.C.4.

Patent Specifications.

209,225. SCOTT, W. H. Apparatus for use in preparing moulds for casting metals.

207,773. HOLTHAUS, J. Movable casting gutters for centrifugally casting metal.

199,390. HOLLEY, G. M. Metal-casting machines.

207,204. METAL COATINGS ON CORES. Farbwerke vorm. Meister, Lucuis & Brüning, Hoechst-on-Main, Germany. November 19, 1923, No. 29,216. Convention date, November 18, 1922. Not yet accepted. Abridged as open to inspection under Sect. 91 of the Act.

A metal coating on hollow or solid cores is provided by applying a mantle of thin rolled sheet metal with an open seam and then welding the seam. The mantle is placed round the core and is drawn very sharply over the latter by means of bandages or clamps and the welding started at the free end of the mantle. The welding is performed step by step in the direction of the longitudinal axis, and at each step the surroundings of the welded place are firmly held by bands or clamps which are moved forward. After the welded seam has cooled, the fash surrounding the seam is removed by grinding and the coating is then turned or ground. The welding may be autogenous, electrical, or any other kind.

XUM